

MSC Guidelines for Review of Cooling System/Keel Cooling System

Procedure Number: E1-5

Revision Date: 02/01/2000

References

- (a) Title 46 Code of Federal Regulations
 - CFR 56.60-1; 56.50-96
 - Passenger Vessels (Subchapter H) must meet F per 77.03-1 - pipe.
 - Cargo and Misc. Vessels (Subchapter I) must meet F per 96.03 - pipe; must meet F per 90.20 - general marine engineering requirements.
 - Small Passenger Vessels (Subchapter K) for engine cooling - 119.420; for keel and grid coolers - 119.422; for piping - 119.710(a)(6) states that these are vital systems, 119.710(c) refers to 56.60 and 119.730 instead of 56.60-20
 - Offshore Supply Vessels (Subchapter L) for cooling - 128.130(a)(7) states that these are vital, refer to 56.60 for equivalent level of safety except as provided in 128.230 for hull penetrations; for keel-cooler installations - 128.420.
 - Small Passenger Vessels (Subchapter T) for cooling - 182.420; for keel coolers - 182.422.
 - (b) Standards and Recommended Practices for Small Craft, American Boat and Yacht Council, Inc. (ABYC)
 - (c) The International Convention for the Safety of Life at Sea (SOLAS) 1974 Regulation II-1: Construction Part B: Openings in the shell plating of passenger ships below the margin line p. 73; Part C: Machinery Installations p. 100
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Disclaimer

These guidelines were developed by the Marine Safety Center staff as an aid in the preparation and review of vessel plans and submissions. They were developed to supplement existing guidance. They are not intended to substitute or replace laws, regulations, or other official Coast Guard policy documents. The responsibility to demonstrate compliance with all applicable laws and regulations still rests with the plan submitter. The Coast Guard and the U. S. Department of Transportation expressly disclaim liability resulting from the use of this document.

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General Review
Guidance

Vessels Subject to Title 46 CFR Subchapter F Referred to in Subchapters D, H, and I

Materials

- ❑ Materials shall conform to the specifications/standards listed in 56.60.

Overboard discharges and shell connections

- ❑ Inlets and discharges shall have some means of preventing the accidental admission of water (56.50-95(a)(1)).
 - ❑ Openings in the vessel's hull shall be kept to a minimum (56.50-95(a)(2))
 - ❑ The thickness of discharge connections outboard of the shutoff valves must meet the following:
 - a) Piping is not less than Sched. 80 for nominal pipe sizes through 8".
 - b) Piping is not less than Sched. 60 for nominal pipe sizes above 8" and below 16".
 - c) Piping is not less than Sched. 40 for nominal pipe sizes above 16".
- ❑ Confirm that the system needs or does not need an automatic return line (56.50-95(b))
 - ❑ Discharges originating at any level must be provided with an automatic, non-return valve at the shell, if penetrating the shell either;
 - a) more than 17.5 inches below the freeboard deck, or,
 - b) less than 23.5 inches above the summer load waterline,
 - ❑ Non-return valve, unless otherwise required, may be omitted if;
 - a) Piping not less than Sched. 80 for nominal pipe sizes through 8".
 - b) Piping not less than Sched. 60 for nominal pipe sizes btwn 8"–16"
 - c) Piping not less than Sched. 40 for nominal pipe sizes above 16".
 - ❑ Discharges originating from spaces below the freeboard deck or from within enclosed superstructures on the freeboard deck shall be fitted with efficient and accessible means for preventing water from passing inboard. Should take the form of one of the following:
 - a) Discharge shall have one automatic non-return valve with a positive means of closing it from above the freeboard deck.
 - b) Exceptions:
 - i) Vertical distance exceeds 0.01L - Where the vertical upward distance from the summer load line to the inboard end of the discharge pipe where flooding can take place exceeds 0.01L (L = Length of Vessel), discharge may have two automatic non-return valves without

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positive means of closing. This is provided that the inboard valve is always accessible for examination.

ii) Vertical distance exceeds 0.02L - Where the vertical distance exceeds 0.02L, a single automatic non-return valve without positive means of closing is acceptable.

- Pipes terminating at the shell shall be fitted with bends or elbows between the outboard openings and the first rigid connection inboard. In no case shall such pipes be fitted in a direct line between the shell opening and the first inboard connection.

Keel Cooler Installations - Subchapter F

Subchapter F: 56.50-96

- System shall be fitted with shutoff valves as close to the skin of the ship as possible (56.50-95(d)(1))
 - Shutoff valves - may be locally controlled in a manned machinery space
 - Shutoff valves - shall be easily accessible - above the floor plates in manned machinery spaces; remotely operable from above the freeboard deck in unmanned machinery spaces (56.50-95(d)(2)).

OR

- Shutoff valves are not required if either of the following:
 - The installation is forward of the collision bulkhead (56.50-96(a)(1))
 - The cooler structure is integral with the ship's hull and meets the requirements in 56.50-96(a)(2)
 - The thickness of inlet and discharge connections outboard of the shutoff valves, and exclusive of sea chests, must be:
 - Not less than that of Schedule 80 for nominal pipe sizes through 8 inches
 - Not less than Schedule 60 for nominal pipe sizes above 8 inches and below 16 inches
 - Not less than Schedule 40 for nominal pipe sizes 16 inches and above.
 - Refer to 56.50-95(f) for specs on material for new vessel installations or replacements in vessels of 150 gross tons and over.
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Vessels Subject to Title 46 CFR Subchapter K

Engine Cooling System

- ❑ Engines must be water-cooled; diesel engines may be air-cooled refer to 119.420(b) for requirements.
- ❑ Engine head block and exhaust manifold must be water jacketed and cooled by water from a pump that operates whenever the engine is operating.
- ❑ A suitable hull strainer must be installed
- ❑ A closed fresh water system may be used.

Engine Cooling Materials

- ❑ Engine cooling systems are vital per 119.710(a)(7).
- ❑ Refer to subchapter F with the exception of referring to 119.730 for nonferrous metallic piping materials; this is summarized above under Keel Cooler Installations - Subchapter F.

Keel Cooling System

- ❑ System must be designed to prevent flooding per 119.422(a).
- ❑ A shutoff valve must be located where the cooler piping penetrates the shell per 119.422(b) unless the grid cooler or keel cooler is integral to the hull as defined in 119.422(e).
- ❑ The thickness of the inlet and discharge connections must be at least Schedule 80 per 119.422(c).
- ❑ Short lengths of approved non-metallic flexible hose may be used per 119.422(d).

Vessels Subject to Title 46 CFR Subchapter L

Materials

- ❑ As a vital system per 128.130(a)(7) refer to 56.60 for materials. The submitter may use materials other than those listed in 56.60 if the submitter shows that their material attains an equivalent level of safety to 56.60.

Hull Penetrations

- ❑ Each piping penetration must meet the specs detailed in subchapter F per 128.230(a). Refer to overboard discharges and shell connections above.

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- ❑ Each overboard discharge and shell connection must meet materials and pressure design of subchapter F per 128.230(b).

Keel cooler

- ❑ Refer to 56.50-96 per 128.420(a). Procedures for complying with 56.50-96 is found above in *Keel Cooler Installations - Subchapter F* except for:
 - ❑ Approved metallic flexible connections may be located below the deepest-load waterline if the system is a closed loop below the waterline and if its vent is located above the waterline.
 - ❑ Fillet welds may be used in the attachment of channels and half-round pipe sections to the bottom of the vessel.
 - ❑ Short lengths of approved non-metallic flexible hose fixed by metallic or non-metallic hose clamps may be used at machinery connection if:
 - ❑ Clamps are corrosion resistant
 - ❑ Clamps do not depend on spring tension
 - ❑ Two clamps on each end per 128.420(d)(3)
 - ❑ Clamps are resistant to vibration, high temps, and brittleness.

Grid cooler

- ❑ Each hull penetration for a grid-cooler installation must be made through a cofferdam or at a sea chest and must be provided with isolation valves per 128.430(a).
- ❑ Each must be protected against damage from debris and grounding by protective guards or by recessing the cooler into the hull.

Vessels Subject to Title 46 CFR Subchapter T

- ❑ All engines must be water cooled per 182.420(a)
- ❑ Engine head, block and exhaust manifold must be water-jacketed and cooled by water from a pump that operates whenever the engine is operating.
- ❑ A suitable hull strainer must be installed in the circulating raw water intake line of an engine cooling water system.
- ❑ A closed fresh water system may be used to cool the engine.
- ❑ Exceptions:
 - ❑ Vessel under 65 feet may comply with ABYC P-4 instead of the above requirements.
 - Marine engines shall be designed for saltwater operation (P-4).

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- Cooling system temps shall conform to the manufacturer's recommendations.
- If a pump is used to supply seawater for cooling an engine and its systems, a self-priming pump which operates whenever the engine is running shall be used.
- Those portions of the engine through which saltwater circulates and which consist of metal alloys shall be of such area relationship as to avoid detrimental galvanic corrosion (dissimilar metals). In general, components of small relative area, such as core plugs and pipe plugs, shall be made of materials which in the galvanic series are cathodic to and close to the other metal alloys with which they are used. Exception: If a closed fresh water cooling system is provided as part of the basic engine.
- Drains or drain plugs shall be provided in liquid cooled engine systems to aid drainage so that when the engine is installed according to recommendations they will assist in avoiding damage from freezing.
- Inboard propulsion engines shall be equipped with instruments at the operator's positions to indicate the temperature of the engine.
- For vessels under 65 feet and carrying not more than 12 passengers refer directly to ABYC P-4 for details on air-cooled engines per 182.420(c).
- An auxiliary gasoline engine may be air cooled when:
 - It has a self-contained fuel system and it is installed on an open deck OR
 - On a vessel under 65 feet carrying not more than 12 passengers, it is in compliance with ABYC P-4.
- A propulsion or aux. Diesel engine may be air cooled when:
 - Installed on an open deck per 182.420(e)(1)
 - Installed in an enclosed space for which ventilation for machinery cooling is provided
 - Installed on a vessel of not more than 65 feet w/ less than 12 passengers per 182.420(e)(3).

Keel and grid cooler installations

- Must be designed to prevent flooding per 182.422(a).
- Shutoff valve must be located where the cooler piping penetrates the shell, as near the shell as practicable, except where the penetration is forward of the collision bulkhead. Exception: Shutoff valves are not required for systems that are integral to the ship, see 182.422(e) for details.

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- ❑ Thickness of the inlet and discharge connections, outboard of the shutoff valves must be Schedule 80.
- ❑ Short lengths of approved non-metallic flexible hose, fixed by two hose clamps at each end, may be used at machinery connections for a keel cooler installation per 182.422(d).